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Research paper

Prevalence of depressive symptoms in people aged 50 years and older: A retrospective cross-sectional study

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ABSTRACT

Background: Depression is a serious health problem worldwide and is often associated with disability and reduced quality of life. In aging societies, early recognition of depression in older adults is highly relevant. Therefore, this study investigated the prevalence of depressive symptoms in individuals aged 50 and older with the aim to identify those at risk for major depression.

Methods: We performed a retrospective cross-sectional study with data from 1000BRAINS to assess depressive symptoms in a sample of 1017 healthy adults aged 50 and older. The prevalence and dimension of depressive symptoms were measured by the Beck Depression Inventory II, and differences between demographic, clinical, and lifestyle-associated variables and the prevalence of depressive symptoms were analyzed.

Results: Depressive symptoms were present in 21.3 % of the participants and were minimal in 14.2 %, mild in 4.5 %, moderate in 1.8 %, and severe in 0.8 %. The prevalence of depressive symptoms was highest in the age group 50 to 59 years, and the prevalence of severe depressive symptoms decreased with increasing age. A positive family history of depression, cognitive impairment, medication intake, and polyneuropathy were associated with significantly higher levels of depressive symptoms.

Limitations: The retrospective cross-sectional design and evaluation of depressive symptoms by a self-rating instrument may limit the generalizability of the results.

Conclusion: This study supports earlier findings of a higher prevalence of depressive symptoms among older adults. The group aged 50 to 59 appears to be particularly affected. Additionally, poor physical health, greater cognitive impairment, and sex-specific factors appear to contribute to depressive symptomatology.

1. Introduction

Depression is often associated with disability and reduced quality of life (James et al., 2018). With prognostic calculations placing depression at the forefront of disease burden by 2030 (Mathers and Loncar, 2006), the imperative for innovative research into early recognition and prediction has never been more critical. This need is particularly pronounced among older adults. For example, research in the US by Kessler et al. (2005) and Steffens et al. (2009) showed the significant prevalence of major depressive episodes among those over 60; this trend is mirrored globally, whereby levels vary across demographics and are associated with factors such as sex, physical health, and cognitive impairment (Djernes, 2006; Luppa et al., 2012; Aziz and Steffens, 2013; Busch et al., 2013; Streit et al., 2023; Volkert et al., 2013). Furthermore, global populations are aging rapidly, particularly in high-income countries; e.g., from 2022 to 2050, the proportion of the population aged 65 years and older is extrapolated to increase from 10 % in 2022 to 16 % in 2050 (Aziz and Steffens, 2013; United Nations, 2022).

In their study, Kessler et al. (2005) reported a 10.8 % lifetime prevalence of major depressive episodes in those aged 60 and older, and

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the Aging, Demographics, and Memory Study found a prevalence of clinical depression of 11.1 % in participants aged 71 and older, with higher rates in those with dementia and pain (Steffens et al., 2009). Djernes (2006) reviewed international studies and found prevalences of major depressive disorder (MDD) of 0.9 % to 9.4 % in older adults (≥ 65 years) living in private households and 14 % to 42 % in older adults in institutional settings. Rates were higher in women and those with physical illnesses, cognitive impairments, loneliness, and a history of depression. Luppa et al. (2012) reported prevalences of 4.6 % to 9.3 % for MDD and 4.5 % to 37.4 % for depressive disorders in those aged 75 and older.

In older people, depression interacts significantly with physical health issues such as vascular risk factors, cerebrovascular incidents, cerebral infarctions, white matter hyperintensities, myocardial infarction, and coronary artery disease (Aziz and Steffens, 2013, Taylor et al., 2013). It also shows a bidirectional relationship with obesity, stroke, and coronary heart disease (Penninx et al., 2013; Gold et al., 2020). The strong link with cardiovascular and cerebrovascular conditions suggests shared mechanisms (Alexopoulos, 2005, 2019). Additionally, depression is common in neurodegenerative disorders such as Alzheimer's and Parkinson's disease as well as Lewy body and frontotemporal dementia, highlighting its complex relationship with cognitive and neurological health (Burgut et al., 2006). Patients with polypharmacy and those receiving drugs such as beta-blockers and proton pump inhibitors (PPI) also have a higher risk for depression (Qato et al., 2018, Laudisio et al., 2018).

Epidemiological studies on the prevalence of depressive symptoms across age groups are important because they help to develop early recognition strategies and intervention options to better address late-life depression (Blazer, 2003). The German Health Interview and Examination Survey for Adults (DEGS) found that the lifetime prevalence of depression increases with age: The prevalence was highest in the 60 to 69 age group (17.3 %), and lowest in the 18 to 29 age group (6.3 %) (Scheidt-Nave et al., 2012; Kamtsiuris et al., 2013). Depressive symptoms were most prevalent in the 20 to 29 age group (9.9 %) (Busch et al., 2013), which was in line with the US Behavioral Risk Factor Surveillance System findings (Strine et al., 2008). Busch et al. (2013) also found that lower socioeconomic status was linked to higher depression risk. The German National Cohort (NAKO) found the highest lifetime depression rates in the 50 to 59 age group and similar prevalences of depressive symptoms in the 20 to 29 and 50 to 59 age groups (10.0 % vs 9.3 %, respectively) (Streit et al., 2023); furthermore, lower educational level, positive family history, anxiety, and stress were associated with depressive symptoms (Streit et al., 2023). A meta-analysis of 25 studies found a higher prevalence of dimensional than categorical depression (Volkert et al., 2013), and an earlier study found that about 27 % of adults aged 60 and older reported depressive symptoms but only 0.8 % met criteria for MDD (Blazer et al., 1987).

In summary, evaluating the prevalence of depressive symptoms in late middle and older age is crucial given the ongoing demographic shifts and because early detection is a prerequisite for preventing severe disease progression and chronicity. Subclinical depressive symptoms that do not fulfil the criteria of a MDD may be part of a clinical high risk state (CHR—D) of depression and associated with functional decline, increased mortality (Meisenzahl et al., 2024; Biella et al., 2019; Benasi et al., 2021). Preventive strategies are important because in primary care settings, depressive symptoms that are not clinical depression are the most important risk factor for depression in older age (Schoevers et al., 2006). Therefore, this study aimed to examine the prevalence of depressive symptoms stratified by severity in individuals aged 50 years and older. In addition, differences regarding severity of depression symptoms and sociodemographic variables, cognition, comorbidities as well as medication were assessed.

2. Methods

Participants were recruited from the 1000BRAINS population (Caspers et al., 2014), a subgroup of the Heinz Nixdorf Recall (HNR) study 10-year follow-up cohort (Schmermund et al., 2002) and the HNR MultiGeneration Study (Kowall et al., 2021). The HNR studies collected health data and relevant social and environmental information from people in the Ruhr metropolitan area. Between 2000 and 2003, 4814 people were enrolled in the HNR study. Participants were interviewed annually about their health and closely examined again after 5 and 10 years. The HNR MultiGeneration Study included 1237 spouses and 1660 adult children of HNR study participants and started recruitment in 2013.

In 1000BRAINS, the baseline assessment comprised standardized, semi-structured interviews and questionnaires, collection of biomaterial, and magnetic resonance imaging (MRI; Caspers et al., 2014). Subjects not eligible for MRI measurement were excluded. Sociodemographic characteristics included age, sex, marital status, and education level (according to the International Standard Classification of Education 97 (ISCED 97) criteria) (UNESCO United Nations Educational and Scientific and Cultural Organization, 2003). Depressive symptoms were evaluated by the self-report Beck Depression Inventory II (BDI-II; Hautzinger et al., 2006), which comprises 21 items about cognitive-affective (e.g., sadness, pessimism, fear of failure, loss of happiness, and feelings of guilt) and somatic symptoms (e.g., loss of appetite, sleeping problems, and tiredness) during the preceding two weeks and categorized depending on the sum score in no depression (BDI II <9), minimal (BDI II = 9–13), mild (BDI II = 14–19), moderate (BDI II = 20–28) and high (BDI II >28) depression (Storch et al., 2004; Bridwell et al., 2015). The questionnaires asked about quality of life (Nuremberg Life Quality Questionnaire; Oswald and Fleischmann, 1997), daily activity (Nuremberg Daily Activities Questionnaire; Oswald and Fleischmann, 1997), behavioral and personality changes (Jülicher Inventar zu frontalem Verhalten, adapted from the frontal behavioral inventory (FBI), Kertesz et al., 1997 and Freiburg Personality Inventory (FPI); Fahrenberg et al., 2010), lifestyle factors (i.e., physical activity in hours per week (h/wk), cigarettes smoked per day, and alcohol and lifetime illegal drug use), and life satisfaction (Caspers et al., 2014). Information was also collected on physical complaints and somatic diseases; body mass index; hearing loss; visual impairment; and neurological and/or psychiatric treatment, including family history. Medications were obtained from the HNR study (Schmermund et al., 2002) and assigned to the following categories: antihypertensives, anticoagulants, antidiabetics, lipid reducers, PPIs, inhalers for lung diseases such as chronic obstructive pulmonary disease, vitamin D, levothyroxine, analgesic agents, antidepressants, hypnotics, anticonvulsants, and Parkinson drugs. Finally, the DemTect dementia screening test (to evaluate verbal memory, working memory, word fluency, and cognitive flexibility; Kalbe et al., 2004) were performed. 1000BRAINS was approved by the University of Essen ethics committee, and all participants gave written informed consent.

For the current retrospective cross-sectional analysis, we categorized 1000BRAINS participants into age-stratified subgroups (50–59, 60–69, 70and older) and evaluated severity of depressive symptoms self-assessed with the BDI-II as well as depressive symptomatology separated in cognitive (7 items), affective (5 items) and somatic domains (9 items) in the subgroups (Almeida et al., 2023). Moreover, differences between somatic factors such as physical illnesses, medication intake, and cognitive function regarding depressive symptom severity was examined.

2.1. Statistical analysis

We analyzed frequencies or means and standard deviations (SDs) of depressive symptom severity in the various age groups. Differences in depressive symptoms stratified by age, sex and education were

evaluated by Chi-square tests for categorical variables, and *t*-test for continuous variables. Differences of demographic, clinical, and lifestyle variables regarding depressive symptoms were analyzed by univariate analysis of variance (ANOVA). Corrections were made for age, sex, and education level. Results of the BDI-II were separated in cognitive, affective and somatic domains according to Almeida et al. (2023). Differences in cognitive, affective and somatic domains across the various age groups were analyzed by ANOVA and corrected for sex, educational level and physical complaints using the related item of the FPI. Analyses were performed with SPSS 28.0 (IBM Corp.). A *p*-value of <0.05 was considered statistically significant.

3. Results

3.1. Descriptive statistics 1000BRAINS cohort

The analysis included 1017 participants (456 [44.8 %] women and 561 [55.2 %] men). Only 37 participants were aged 80 years and older (maximum age, 87 years), so all patients aged 70 (N = 350) and older were combined into one subgroup.

3.2. Prevalence of depressive symptoms

Table 1 provides descriptive statistics of demographic, lifestyle, medical, and quality-of-life variables stratified by depressive symptom severity within the 1000BRAINS cohort, categorized based on Beck Depression Inventory II (BDI-II) cut-off scores. The cohort is divided into three groups: no depressive symptoms (N = 770), minimal depressive symptoms (N = 139), and manifest depressive symptoms (N = 70). Regarding depressive symptoms at the cut-off of >13, mild depressive symptoms were the most prevalent, followed by moderate and severe ones. When minimal depressive symptoms were included, the proportion of participants with depressive symptoms increased from 7.1 to 21.3 %. Demographic variables show that the percentage of females increases with depressive symptom severity, from 42.1 % in the no symptoms group to 58.6 % in the manifest group. Similarly, participants with lower educational attainment and those living alone are more prevalent in groups with higher depressive symptoms.

3.3. Depressive symptoms stratified by age, sex and education

Table 2 shows descriptive statistics of clinical variables and depression-associated measures stratified by age groups. The mean BDI-II score was similar in the whole sample and the age groups. Depressive symptoms were most prevalent in the age group 50 to 59 years. Severe depressive symptoms were also most prevalent in this group, and their prevalence decreased with increasing age; in contrast, minimal depressive symptoms increased with increasing age. Participants 70 years and older did not present any moderate or severe depressive symptoms (Table 2, Fig. 1). As expected, with increasing age, the number of participants with suspected mild cognitive impairment and suspected dementia increased (Table 2). The sex distribution was not significantly different between the age groups (X^2 (1) = 3.973; $p = 0.137$). The oldest age group reported significantly less about a history or positive family history of psychiatric treatment. Physical complaints were similar across the age groups, although age-related hearing loss and cataracts increased with increasing age. All musculoskeletal diseases, except artificial joint disease, peaked at around 60 to 69 years. With increasing age, the number of medications increased (F (1,973) = 5.37; $p = 0.021$), particularly antihypertensives, anticoagulants, lipid reducers, and antidiabetics (Table S1).

Table 3 shows descriptive statistics of clinical variables and depression-associated measures stratified by sex. Women had a significantly higher BDI-II score than men and more frequently reported a personal as well as a positive family history of psychiatric treatment. Men had significantly lower DemTect-scores than women.

Table 1
Descriptive statistics of demographic, lifestyle and medical variables across depressive symptom severity in the 1000BRAINS cohort.

Variables	Total	Depressive symptom severity		
		No depressive symptoms	Minimal depressive symptoms	Manifest depressive symptoms
BDI-II cut-off		0–8	9–13	≥14
	N = 1017 (100.0)	N = 770 (78.7)	N = 139 (14.2)	N = 70 (7.1)
Demographic variables				
Female	456 (44.8)	324 (42.1)	77 (55.4)	41 (58.6)
Age, years	66.48 (±7.55)	66.41 (±7.47)	67.40 (±8.11)	64.08 (±7.11)
Native language German	976 (96.0)	743 (96.5)	132 (95.0)	65 (92.9)
ISCED97 education level				
- Low	61 (6.0)	43 (5.6)	10 (7.2)	6 (8.6)
- Intermediate	558 (54.9)	398 (51.8)	87 (62.6)	47 (67.1)
- High	397 (39.1)	328 (42.7)	42 (30.2)	17 (24.3)
Living with a partner	789 (78.4)	610 (80.1)	109 (79.0)	41 (59.4)
Living alone				
- Single	41 (4.0)	28 (3.6)	7 (5.0)	5 (7.1)
- Divorced	74 (7.3)	51 (6.6)	9 (6.5)	13 (18.6)
- Widowed	102 (10.0)	73 (9.5)	13 (9.4)	10 (14.3)
Psychiatric variables				
BDI-II	5.43 (±5.63)	3.20 (±2.54)	10.32 (±1.34)	20.29 (±6.84)
Past or current psychiatric treatment	166 (17.2)	96 (13.1)	34 (26.0)	32 (47.1)
Positive family history for psych. disorders	182 (18.2)	128 (16.8)	27 (19.7)	22 (33.3)
- First-grade relative	107 (10.5)	76 (9.9)	17 (12.2)	13 (18.6)
- Second-grade relative	47 (4.6)	32 (4.2)	6 (4.3)	6 (8.6)
- Third-grade relative	23 (2.3)	16 (2.1)	3 (2.2)	3 (4.3)
DemTect	14.70 (±2.49)	14.90 (±2.44)	14.23 (±2.54)	13.96 (±2.34)
- No cognitive impairment	812 (81.5)	635 (83.9)	103 (76.9)	49 (71.0)
- Mild cognitive impairment	174 (17.5)	116 (15.3)	30 (22.4)	19 (27.5)
- Suspected dementia	10 (1.0)	6 (0.8)	1 (0.7)	1 (1.4)
Lifestyle variables				
Regular physical activity	806 (80.0)	619 (81.6)	111 (82.2)	52 (74.3)
Physical activity, h/week	4.68 (±5.57)	4.65 (±5.29)	4.88 (±6.32)	4.17 (±6.17)
Smoking	110 (11.0)	84 (11.1)	15 (10.9)	9 (13.0)
- Cigarettes per day	13.42 (±8.85)	12.76 (±8.42)	15.73 (±8.15)	14.56 (±13.79)
Alcohol consumed per week	8.58 (±11.49)	8.93 (±11.22)	7.53 (±12.18)	6.76 (±12.00)
Illegal drug use	30 (2.9)	13 (1.7)	8 (5.8)	9 (13.0)
Quality of life				
NLQ	132.7 (±17.3)	137.4 (±12.5)	120.8 (±15.9)	100.8 (±22.5)
NAA	53.0 (±10.6)	53.8 (±9.8)	51.9 (±11.7)	47.1 (±15.5)
ABC-D	18.6 (±4.4)	18.0 (±3.3)	20.2 (±5.6)	22.0 (±7.2)
FBI	8.8 (±6.1)	7.7 (±5.2)	10.6 (±5.3)	17.5 (±8.5)

(continued on next page)

Table 1 (*continued*)

Variables	Total	Depressive symptom severity		
		No depressive symptoms	Minimal depressive symptoms	Manifest depressive symptoms
BDI-II cut-off		0–8	9–13	≥14
	N = 1017 (100.0)	N = 770 (78.7)	N = 139 (14.2)	N = 70 (7.1)
Somatic variables				
Physical complaints, FPI	2.48 (±2.26)	1.95 (±1.82)	3.86 (±2.32)	5.6 (±2.81)
Age-related hearing loss	155 (15.5)	116 (15.3)	27 (19.7)	8 (11.9)
Other hearing loss	132 (13.3)	101 (13.3)	18 (13.3)	11 (16.2)
Hearing aid	78 (7.8)	59 (7.8)	11 (8.1)	6 (8.8)
Cataract	201 (20.6)	147 (19.8)	30 (22.9)	15 (21.7)
- Operation performed	120 (59.7)	90 (61.2)	19 (63.3)	4 (26.7)
Glaucoma	49 (5.1)	34 (4.7)	11 (8.6)	1 (1.5)
- Operation performed	4 (8.2)	2 (5.9)	0 (0.0)	1 (100.0)
Musculoskeletal diseases				
- Joint diseases	334 (33.4)	237 (31.3)	57 (41.6)	28 (40.6)
- Artificial joint	25 (2.5)	14 (1.8)	8 (5.8)	2 (2.9)
- Disc prolapse	207 (20.7)	150 (19.8)	34 (24.8)	16 (23.2)
- Polyneuropathy	140 (14.0)	85 (11.2)	31 (22.6)	17 (25.0)
Past or current neurological treatment	215 (21.5)	143 (18.8)	42 (30.7)	24 (35.8)
BMI	27.35 (±4.17)	27.3 (±4.1)	27.4 (±4.3)	27.6 (±4.8)
- Underweight	1 (0.1)	1 (0.1)	–	–
- Normal weight	291 (29.4)	218 (29.1)	42 (30.7)	21 (30.4)
- Preobesity	453 (45.7)	356 (47.5)	57 (41.6)	25 (36.2)
- Obesity	246 (24.8)	175 (23.3)	38 (27.7)	23 (33.3)
Medication intake				
Quantity of medication taken	1.88 (±1.97)	1.81 (±1.96)	2.12 (±2.05)	2.29 (±2.03)
Antihypertensives	494 (48.6)	370 (48.1)	68 (48.9)	38 (54.3)
Lipid reducers	183 (18.0)	142 (18.4)	21 (15.1)	16 (22.9)
Proton pump inhibitors	115 (11.3)	77 (10.0)	20 (14.4)	17 (24.3)
Anticoagulants	177 (17.4)	131 (17.0)	27 (19.4)	12 (17.1)
Antidiabetics	82 (8.1)	63 (8.2)	13 (9.4)	2 (2.9)
Levothyroxine	171 (16.8)	122 (15.8)	30 (21.6)	15 (21.4)
Analgesic agents	59 (5.8)	40 (5.2)	10 (7.2)	8 (11.4)
Inhalers for lung diseases	40 (3.9)	32 (4.2)	6 (4.3)	1 (1.4)
Parkinson drugs	17 (1.7)	10 (1.3)	3 (2.2)	3 (4.3)
Anticonvulsants	17 (1.7)	7 (0.9)	6 (4.3)	3 (4.3)
Vitamin D	29 (2.9)	14 (1.8)	11 (7.9)	4 (5.7)
Hypnotics	2 (0.2)	0 (0.0)	1 (0.7)	1 (1.4)
Antidepressants	95 (9.4)	47 (6.1)	22 (15.8)	22 (31.4)

Numbers present either absolute numbers plus percent or mean plus standard deviation; frequencies are given for the participants with valid data records for the respective measure; missing Beck Depression Inventory II (BDI-II) values n = 38; ABC-D, Activities-Specific Balanced Confidence Scale; alcohol consumption per week in drinking units (glass of wine, beer, spirits); BMI, body mass index in weight in kg/height in m^2 (underweight <18.49, normal weight 18.5–24.9, preobesity 25–29.9, obesity ≥ 30); FPI = Freiburger personality inventory; ISCED97, International Standard Classification of Education 97; FBI, Frontal Behavioral Inventory; NLQ, Nuremberg Life Quality Questionnaire; NAA, Nuremberg Daily Activities Questionnaire; TBI = traumatic brain injury.

Table 2
Descriptive statistics of clinical variables across the age groups.

Variables	Age groups			*p*-Value
	50–59 y	60–69 y	70–87 y	
	N = 233 (22.9)	N = 434 (42.7)	N = 350 (34.4)	
Clinical variables				
BDI-II	5.64 (±6.70) [4.77–6.52]	5.45 (±6.00) [4.88–6.03]	5.26 (±4.17) [4.81–5.71]	0.726[1]
Depression	23 (10.1) [6.2–14.1]	31 (7.3) [4.8–9.8]	16 (4.8) [2.5–7.2]	0.058[2]
- No depression	175 (77.1) [66.0–88.2]	335 (79.4) [72.1–86.6]	260 (78.8) [73.0–84.6]	0.792[2]
- Minimal depression	29 (12.8) [1.7–23.9]	56 (13.3) [6.0–20.5]	54 (16.4) [10.5–22.2]	0.378[2]
- Mild depression	13 (5.7) [0–16.8]	15 (3.6) [0–10.8]	16 (4.8) [0–10.7]	0.413[2]
- Moderate depression	6 (2.6) [0–13.7]	12 (2.8) [0–10.1]	0 (0.0) –	0.009[2] (b, c)
- Severe depression	4 (1.8) [0–12.8]	4 (0.9) [0–8.2]	0 (0.0) –	0.076[2]
Positive family history for psych. disorders	59 (25.8) [20.1–31.4]	82 (19.2) [15.4–23.0]	41 (12.0) [8.5–15.4]	<0.001[2] (b, c)
- First-grade relative	32 (13.7) [3.7–23.7]	51 (11.8) [5.1–17.0]	24 (6.9) [1.0–12.7]	0.016[2] (b, c)
- Second-grade relative	13 (5.6) [0–15.6]	23 (5.3) [0–11.3]	11 (3.1) [0–9.0]	0.263[2]
- Third-grade relative	10 (4.3) [0–14.3]	7 (1.6) [0–7.6]	6 (1.7) [0–7.6]	0.059[2]
Past or current psychiatric treatment	48 (21.4) [16.0–26.8]	89 (21.7) [17.7–25.7]	29 (8.7) [5.7–11.8]	<0.001[2] (b, c)
DemTect	14.54 (±2.55) [14.21–14.87]	15.32 (±2.27) [15.10–15.53]	14.02 (±2.53) [13.75–14.29]	<0.001[1] (a, b, c)
- No cognitive impairment	174 (76.0) [70.0–82.0]	384 (89.7) [86.7–92.7]	254 (74.9) [69.8–80.1]	<0.001[2] (a, c)
- Mild cognitive impairment	52 (22.7) [16.7–28.7]	43 (10.0) [7.1–13.0]	79 (23.3) [18.2–28.4]	<0.001[2] (a, c)
- Suspected dementia	3 (1.3) [0–7.3]	1 (0.2) [0–3.2]	6 (1.8) [0–6.9]	0.092[2]

Numbers present either absolute numbers plus percent or mean plus standard deviation, 95 % confidence interval in square brackets; frequencies are given for the participants with valid data records for the respective measure; significant group difference between 50–59 y and 60–69 y (a), 50–59 y and 70–87 y (b) and 60–69 y and 70–87 y (c); BDI-II, Beck Depression Inventory II (depression cut-off BDI-II ≥ 14, no depression 0–8, minimal depression 9–13, mild depression 14–19, moderate depression 20–28, severe depression >28); DemTect, test for the early detection of cognitive impairment (no cognitive impairment >12, mild cognitive impairment 9–12, suspected dementia <9).

[1] Univariate ANOVA (two-tailed).

[2] X^2-test (two-tailed).

Table 4 shows descriptive statistics of clinical variables and depression-associated measures stratified by educational level. Most participants had an intermediate education level (N = 558, 54.9 %), only a few participants had a low level (N = 61, 6 %). Higher educated participants had significantly lower BDI-II and higher DemTect-scores. No significant differences were depicted regarding history or positive family of psychiatric treatment.

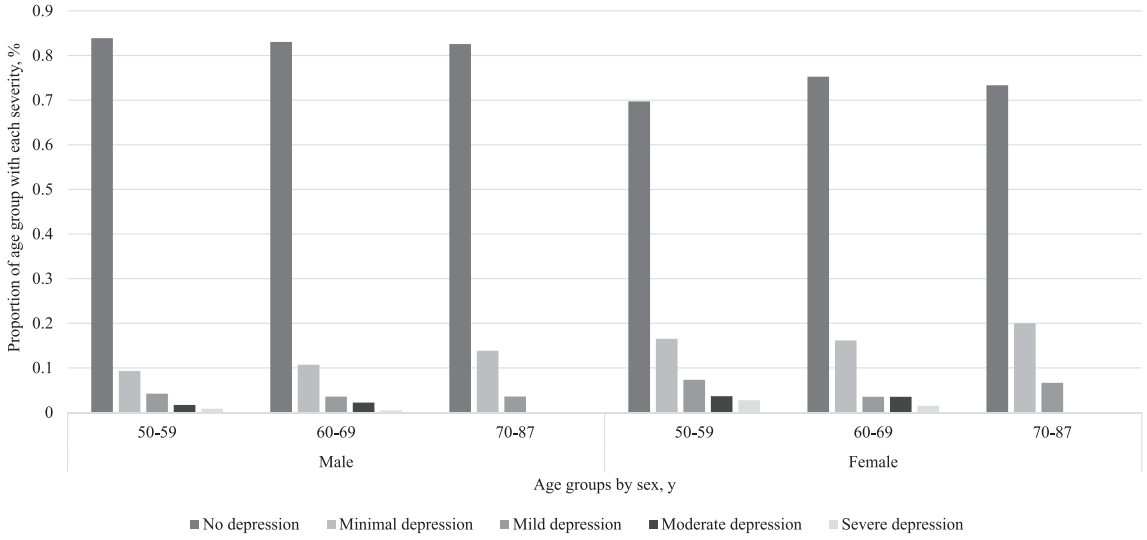

Fig. 1. Distribution of depression severity by age group and sex.

Table 3
Descriptive statistics of clinical variables across females and males.

Variables	Females	Males	*p*-Value
	N = 456 (44.8)	N = 561 (55.2)	
Clinical variables			
BDI-II	6.40 (±6.23)	4.63 (±4.96)	<0.001[1]
Depression	41 (9.3)	29 (5.4)	0.019[2]
- No depression	324 (73.3)	446 (83.1)	<0.001[2]
- Minimal depression	77 (17.4)	62 (11.5)	0.009[2]
- Mild depression	24 (5.4)	20 (3.7)	0.200[2]
- Moderate depression	11 (2.5)	7 (1.3)	0.170[2]
- Severe depression	6 (1.4)	2 (0.4)	0.088[2]
Positive family history for psych. disorders	100 (22.2)	82 (14.6)	0.003[2]
- First-grade relative	55 (12.1)	52 (9.3)	0.149[2]
- Second-grade relative	30 (6.6)	17 (3.0)	0.007[2]
- Third-grade relative	12 (2.6)	11 (2.0)	0.474[2]
Past or current psychiatric treatment	87 (19.8)	79 (15.0)	0.046[2]
DemTect	15.30 (±2.38)	14.21 (±2.47)	<0.001[1]
- No cognitive impairment	395 (89.0)	417 (75.5)	<0.001[2]
- Mild cognitive impairment	48 (10.8)	126 (22.8)	<0.001[2]
- Suspected dementia	1 (0.2)	9 (1.6)	0.027[2]

Numbers present either absolute numbers plus percent or mean plus standard deviation; frequencies are given for the participants with valid data records for the respective measure; BDI-II, Beck Depression Inventory II (depression cut-off BDI-II ≥ 14, no depression 0–8, minimal depression 9–13, mild depression 14–19, moderate depression 20–28, severe depression >28); DemTect, test for the early detection of cognitive impairment (no cognitive impairment >12, mild cognitive impairment 9–12, suspected dementia <9).

[1] *t*-Test (two-tailed).

[2] X^2-test (two-tailed).

3.4. Differences between physical condition, medication and cognitive factors regarding depressive symptom severity

Lifestyle patterns reveal that regular physical activity declines with increasing depressive symptoms, and smoking tend to be higher among participants with manifest depressive symptoms. However, The BDI-II score was not significantly different between physically active and inactive participants or between smoking and non-smoking participants (Table 5). Participants with a life-time prevalence of illegal drug use reported significantly more depressive symptoms (Table 5). Regression analysis reveals that severity of depressive symptoms was not associated with lifestyle factors such as physical activity in hours per week ($r = -0.008$, $p = 0.805$), number of cigarettes per day ($r = 0.026$, $p = 0.425$), and alcohol consumption ($r = -0.008$, $p = 0.794$).

Quality-of-life measures, such as the Nuremberg Life Quality Questionnaire (NLQ), demonstrate a notable decline in scores with increased depressive symptoms, indicating reduced perceived quality of life.

Inferential statistics showed that participants with history of psychiatric treatment reported significantly more depressive symptoms (Table 5) and that those with a positive family history of psychiatric disorders had significantly higher BDI-II scores (Table 2, S2).

Obesity, joint disease and polyneuropathy were all associated with higher BDI-II scores (Table S2). Participants taking antidepressants, vitamin D, antihypertensives, PPIs, and anticonvulsants had higher BDI-II scores than those not taking these drugs (Table 5).

Participants with suspected mild cognitive impairment had more depressive symptoms than those with either no cognitive impairment or suspected dementia (measured with the DemTect, a screening tool for cognitive decline (Kalbe et al., 2004), Table 5, S2). Furthermore, higher BDI-II scores were associated with significantly lower DemTect scores ($\beta = 0.148$, $p < 0.001$).

3.5. Prevalence of cognitive, affective and somatic depressive symptoms in the various age groups

Participants reported more about somatic symptoms (M = 3.59; SD ± 3.22) than cognitive (M = 1.05; SD ± 1.87) or affective symptoms (M = 0.79; SD ± 1.35) in the BDI II (Fig. S1). Symptom severity of the somatic domain tend to increase across the age groups but did not differ significantly ($F(2;954) = 0.449$, $p = 0.638$, Fig. S2). The age groups 50 to 59 years and 60 to 69 years exhibited significantly higher cognitive symptoms than the age group 70 years and older ($F(2;955) = 6.265$, $p = 0.002$). Furthermore, in the youngest age group, affective symptom severity was significantly higher than for the oldest age group ($F(2;955) = 3.709$, $p = 0.025$; Fig. S2).

4. Discussion

This study aimed to evaluate the prevalence of depressive symptoms and the association between depressive symptoms and clinical variables such as cognition, comorbidities and medication in older adults aged 50 and above. About a fifth (21.3 %) of participants had depressive symptoms (14.2 %, minimal; 4.5 %, mild; 1.8 %, moderate; and 0.8 %, severe). With increasing age, the prevalence of severe depressive

Table 4
Descriptive statistics of clinical variables across educative levels.

Variables	Low education	Intermediate education	High education	*p*-Value
	N = 61 (6.0)	N = 558 (54.9)	N = 397 (39.1)	
Clinical variables				
BDI-II	6.92 (±5.55)	6.14 (±5.94)	4.24 (±4.98)	<0.001[1] (b, c)
Depression	6 (10.2)	47 (8.8)	17 (4.4)	0.023[2] (c)
- No depression	43 (72.9)	398 (74.8)	328 (84.8)	0.001[2] (b, c)
- Minimal depression	10 (16.9)	87 (16.4)	42 (10.9)	0.051[2]
- Mild depression	5 (8.5)	28 (5.3)	11 (2.8)	0.068[2]
- Moderate depression	0 (0.0)	13 (2.4)	5 (1.3)	0.244[2]
- Severe depression	1 (1.7)	6 (1.1)	1 (0.3)	0.262[2]
Positive family history for psych. disorders	7 (11.7)	92 (16.8)	83 (21.2)	0.093[2]
- First-grade relative	5 (8.2)	52 (9.3)	50 (12.6)	0.221[2]
- Second-grade relative	2 (3.3)	21 (3.8)	24 (6.0)	0.223[2]
- Third-grade relative	0 (0.0)	16 (2.9)	7 (1.8)	0.249[2]
Past or current psychiatric treatment	11 (18.6)	90 (17.1)	65 (17.0)	0.951[2]
DemTect	14.07 (±2.84)	14.44 (±2.53)	15.16 (±2.30)	<0.001[1] (b, c)
- No cognitive impairment	37 (62.7)	439 (80.8)	336 (85.5)	<0.001[2] (a, b)
- Mild cognitive impairment	21 (35.6)	96 (17.7)	56 (14.2)	<0.001[2] (a, b)
- Suspected dementia	1 (1.7)	8 (1.5)	1 (0.3)	0.157[2]

Numbers present either absolute numbers plus percent or mean plus standard deviation; frequencies are given for the participants with valid data records for the respective measure; significant group difference between low and intermediate (a), low and high (b) and intermediate and high education (c); BDI-II, Beck Depression Inventory II (depression cut-off BDI-II ≥ 14, no depression 0–8, minimal depression 9–13, mild depression 14–19, moderate depression 20–28, severe depression >28); DemTect, test for the early detection of cognitive impairment (no cognitive impairment >12, mild cognitive impairment 9–12, suspected dementia <9).
[1] Univariate ANOVA (two-tailed).
[2] X^2-test (two-tailed).

symptoms decreased and that of minimal depressive symptoms increased.

4.1. Prevalence of depressive symptoms

We found a relatively high prevalence of depressive symptoms, which aligns with other studies: A meta-analysis showed a global prevalence of depressive symptoms of 19.47 % in people 50 years and older (Volkert et al., 2013), and a study found a global prevalence of depression of 28.4 % in older adults (Hu et al., 2022). However, prevalence varies with geographic region, screening tool, sample size, and study quality (Hu et al., 2022). Another study found that 6.1 % of cognitively healthy individuals aged 60 years and older had moderate to severe depressive symptoms as measured with the BDI-II (Krell-Roesch et al., 2018); this prevalence may be a little lower than that in our sample (7.2 %) because Krell-Roesch et al. excluded cognitively impaired individuals. Patients with comorbidities have a higher prevalence of depressive symptoms; for example, 20.3 % of patients with implantable cardioverter defibrillators and 35 % of those with heart failure showed mild to severe depressive symptoms measured with the BDI-II (Ensslin et al., 2022; Dekker et al., 2014). The National Health and Nutrition Examination Survey (NHANES) reported that 20.1 % of adults aged 18 and older had significant depressive symptoms (score on the German Health Questionnaire for Patients [PHQ-9; Löwe et al., 2002], ≥ 5), most of which were mild (PHQ-9 score, 5–9) (Shim et al.,

Table 5
Results of ANOVA between several demographic, lifestyle and clinical factors regarding BDI-II.

Between-subject factor	*F*	df (between groups)	df (within groups)	*p*	η^2
Demographic variables					
Sex	**11.27**	**1**	**974**	**<0.001**	**0.011**
Age group (years)	0.76	2	973	0.467	0.002
Native language German	1.99	1	973	0.159	0.002
ISCED97	**10.06**	**2**	**973**	**<0.001**	**0.020**
Living with partner	**5.54**	**1**	**964**	**0.019**	**0.006**
Lifestyle variables					
Regular physical activity per week	0.69	1	958	0.405	0.001
Smoking	0.14	1	958	0.709	<0.001
Illegal drug consumption	**37.97**	**1**	**958**	**<0.001**	**0.038**
Clinical variables					
Positive family history	**20.18**	**1**	**958**	**<0.001**	**0.021**
Antidepressant intake	**72.24**	**1**	**972**	**<0.001**	**0.069**
Past or current psych. treatment	**86.24**	**1**	**925**	**<0.001**	**0.085**
DemTect classes	**5.98**	**2**	**953**	**0.003**	**0.012**
BMI classes	**3.17**	**2**	**949**	**0.043**	**0.007**
Somatic variables					
Age related hearing loss	0.76	1	956	0.385	0.001
Other hearing loss	1.93	1	955	0.165	0.002
Hearing aid	0.44	1	954	0.509	<0.001
Cataract	0.31	1	939	0.576	<0.001
Glaucoma	0.04	1	917	0.851	<0.001
Joint disease	**9.27**	**1**	**958**	**0.002**	**0.010**
Artificial joint	1.92	1	957	0.166	0.002
Disc prolapse	1.61	1	957	0.205	0.002
Polyneuropathy	**22.05**	**1**	**956**	**<0.001**	**0.023**
Past or current neuro. treatment	**21.55**	**1**	**958**	**<0.001**	**0.022**
Medication intake					
General medication intake	**5.37**	**1**	**973**	**0.021**	**0.005**
Antihypertensives	**4.34**	**1**	**973**	**0.038**	**0.004**
Lipid reducers	0.19	1	973	0.665	0.000
Proton pump inhibitors	**22.15**	**1**	**973**	**<0.001**	**0.022**
Anticoagulants	2.50	1	973	0.114	0.003
Antidiabetics	0.16	1	973	0.693	0.000
Levothyroxine	2.22	1	973	0.136	0.002
Analgesic agents	2.38	1	973	0.123	0.002
Inhalers for lung diseases	0.19	1	973	0.891	0.000
Parkinson's drugs	1.65	1	973	0.200	0.002
Anticonvulsants	**7.03**	**1**	**973**	**0.008**	**0.007**
Vitamin D	**11.56**	**1**	**973**	**<0.001**	**0.012**
Antidepressants	**72.24**	**1**	**972**	**<0.001**	**0.069**

ANOVA = analysis of variance; BDI-II = Beck Depression Inventory II; ISCED97 = International Standard Classification of Education 97; BMI = body mass index (body weight in kg/body size in m^2); DemTect = Test for the early detection of cognitive impairment; df = degrees of freedom; corrected for age, sex and ISCED97.
Significant variables in bold.

2011). Unlike our study, NHANES found no significant age-related decrease in severe depressive symptoms. This difference may be due to the broader age groups in NHANES: All individuals aged 55 and older were combined into one group, which may have masked the age-related variations observed in our more granular age groupings.

The European Health Interview Survey Third Wave reported a prevalence of 8.22 % for relevant depressive symptoms in the general population aged 15 to over 75 years in Germany, with higher rates in women and adults aged 75 and older (Arias-de la Torre et al., 2023). However, the survey primarily collected data on moderate to severe depressive symptoms. Similar to our study, Busch et al. (2013) showed that severe depressive symptoms (measured with the PHQ-9) decreased with increasing age.

The clinical pictures and possible disease stages of depression are heterogeneous and include stages with undiagnosed depression, subthreshold depression, cognitive decline, and the MDD prodromal state. Therefore, if studies focus only on moderate to severe symptoms (e.g., Busch et al., 2013; Arias-de la Torre et al., 2023), they may overlook a significant portion of the population at risk (Kessler et al., 2005). Evaluating mild depressive symptoms, as we did in our study, is crucial for several reasons: Such symptoms can be early indicators of more severe mental health issues, and studies have shown that individuals with mild depressive symptoms are at higher risk of developing MDD if their symptoms are not addressed early on (Cuijpers and Smit, 2004; Meeks et al., 2011). Early detection and intervention can prevent progression to more severe depression, and early intervention for mild symptoms can be less intensive and more cost effective than treating severe depression. Furthermore, mild depressive symptoms can also significantly impact an individual's quality of life, social relationships, and well-being (Judd et al., 1997) and are often associated with and can exacerbate chronic physical conditions, such as cardiovascular diseases and diabetes (Katon, 2011). Older adults have a high probability of remaining depressed for over a year (Thielke et al., 2010; Meeks et al., 2011). In summary, these findings support the increased focus on prevention (Cuijpers and Smit, 2008; Reynolds, 2008).

4.2. Sociodemographic factors and depressive symptoms

Women and participants with a low level of education had significantly more depressive symptoms, which is in accordance with the findings of other studies (Djernes, 2006; Busch et al., 2013; Streit et al., 2023; Lozupone et al., 2022; Mardiana et al., 2022; Meeks et al., 2011). Cognitive performance was higher in participants with higher educational level. Especially in old age, a low educational level seems to be a risk factor for depression (Köhler et al., 2018) and also dementia (Livingston et al., 2020). Participants living with a partner described fewer depressive symptoms than single, divorced, or widowed participants. Another risk factor for MDD is the loss of spouse (Köhler et al., 2018; Schoevers et al., 2006).

4.3. Psychiatric history and depressive symptoms

A history of psychiatric treatment and a positive family history of psychiatric disorders were associated with greater severity of depressive symptoms, which is in line with other studies (Streit et al., 2023; Biella et al., 2019). There were no differences between the educational level and history of psychiatric treatment or a positive family history of psychiatric disorders. However, since BDI-scores were higher in lower educated participants, a higher utilization of psychiatric treatment was expected. In our study, participants with a life-time prevalence of illegal drug use also had significantly more depressive symptoms. In our sample, 2.9 % of participants reported illegal drug use, and the 2001–2002 National Epidemiologic Survey of Alcohol and Related Conditions found a lifetime prevalence of non-medical drug use of <4 % in adults aged 65 years and older (Moore et al., 2009). Information on psychiatric comorbidity with substance use disorders in old age is scarce, but in middle-aged and older individuals, alcohol and substance use disorders are associated with depression (Wu and Blazer, 2014). We found an association only between illegal drug use and greater depressive symptom severity.

4.4. Cognition and depressive symptoms

Participants with cognitive impairment measured with the DemTect (Kalbe et al., 2004) had a greater severity of depressive symptoms. Furthermore, those with suspected mild impairment had more depressive symptoms than those with no impairment, which is in accordance with findings that depressive symptoms occur especially in the early phase of cognitive decline (Djernes, 2006). In late-life depression, impairments occur in verbal learning, memory, and motor speed (Thomas et al., 2009; Invernizzi et al., 2021). As pathomechanisms, changes in grey matter volume in the prefrontal, anterior cingulate cortex, striatum, and hippocampus and white matter hyperintensities are discussed (Invernizzi et al., 2021; Kim and Han, 2021).

Others showed that cortical amyloid deposition in cognitively healthy older adults was associated with higher odds of depression measured with the BDI (Krell-Roesch et al., 2018). Late-life depression is a risk factor for dementia and occurs in 50 % of patients with Alzheimer's disease (Livingston et al., 2020; Chi et al., 2014; Kuo et al., 2020). A depressive episode, especially in old age, increases the risk for dementia, and a meta-regression revealed that the risk decreases with the length of follow-up (Prince et al., 2014; Singh-Manoux et al., 2017; Almeida et al., 2017; Livingston et al., 2020). Therefore, Livingston et al. (2020) summarized that in old age, a reduction in cognitive reserve due to a depressive episode may increase the risk of developing dementia. Furthermore, brain neuroplasticity is assumed to be negatively influenced by oxidative stress, inflammation, and vascular changes during a depressive episode (Alexopoulos, 2019). Another bidirectional link is that depression and cognitive impairment are associated with reduced social activities and networks (Kelly et al., 2017; Taylor et al., 2018). To conclude, cognitive impairment may be a prodrome of not only Alzheimer's disease, but also late-life depression and depressive symptoms.

4.5. Medication and depressive symptoms

Depressive symptoms were significantly associated with intake of medications, including antidepressants, vitamin D, antihypertensives, PPIs, and anticonvulsants. Quantity of somatic drug intake was associated with greater symptom severity, which is consistent with Qato et al. (2018) and Laudisio et al. (2018). Common side effects for antihypertensives, PPIs and analgesics are depression. Use of PPIs increased the probability of depression in participants aged 75 years and older even after correction for peptic diagnosis or antidepressant medication (Laudisio et al., 2018). Results of the Berlin Aging Study showed that 35.3 % of participants aged over 70 were being treated for at least five conditions: The most common was hypertension, followed by peripheral vascular disease, cardiac failure, hypercholesteremia, and angina pectoris or myocardial infarction (Hillen et al., 2000). These findings suggest the need for careful monitoring of depressive symptoms, drug-drug interactions and monitoring for adverse reactions due to the lower tolerability in older adults with polypharmacy (Holvast et al., 2017).

4.6. Chronic physical conditions and depressive symptoms

Depression was significantly associated with obesity, joint disease, and polyneuropathy. The risk for a depressive episode is twice as high in people with multimorbidity than in those without it and three times higher in those with chronic physical conditions than in those without them (Read et al., 2017). Various pathomechanisms can cause joint diseases and polyneuropathy, and inflammatory or cardiovascular diseases are often responsible; for example, rheumatoid arthritis, diabetes mellitus, and chronic kidney diseases often coexist with depression.

Dziemidok et al. (2023) found that depressive symptoms were associated with diabetic distal symmetric polyneuropathy and that in patients with this disease, depression severity correlated significantly with body mass index, severity of neuropathy symptoms, and lower education level. Furthermore, a large cohort study showed a higher risk for depression in painless diabetic polyneuropathy and particularly in painful diabetic polyneuropathy; neuropathic pain and its severity and cognitive processing (pain catastrophizing) were identified as dominant risk factors for depression (Kec et al., 2022). Chronic low-grade inflammation, insulin resistance, and impaired thrombogenesis are pathophysiological pathways in both depression and cardiovascular diseases (Chávez-Castillo et al., 2020, 2017) and the inflammatory pathways of depression and rheumatoid arthritis may also be linked (Nerurkar et al., 2019).

Obesity increases insulin resistance and often also leptin resistance, which causes a lack of satiety (Sáinz et al., 2015). In depression, leptin potentiates the hypothalamus-pituitary-adrenal axis and increases interleukin 6 and tumor necrosis factor alpha expression (Agrawal et al., 2011). Furthermore, expression of adiponectin, which is anti-inflammatory and upregulated by weight loss, was found to be down-regulated by glucocorticoid signaling, which could be interpreted as another link between depression and obesity (Taylor and Macqueen, 2010).

Polyneuropathy, joint disease, and obesity are all associated with physical decline. Depression itself accelerates the biological aging process and leads to cognitive and physical decline (Szymkowicz et al., 2023), which may explain why patients with both depression and frailty have higher mortality rates (Lugtenburg et al., 2021) and why comorbidities such as orthopedic disease or arthritis worsen outcome in patients with late-life depression (Uysal Cesur and Poyraz, 2023). Patients with somatic illnesses associated with physical decline should be monitored for depressive symptoms since they are associated with further reduction in quality in life and worsen outcome.

4.7. Variations in cognitive, affective and somatic domains measured with the BDI-II

All age groups reported more about somatic symptoms than affective or cognitive. When comparing the age groups, there was no difference in the somatic domain. Common somatic symptoms in late-life Depression are sleep disturbance, fatigue, psychomotor retardation and cognitive complaints (Gallo et al., 1994; Christensen et al., 1999; Fiske et al., 2009). Other studies in younger and older populations showed that late-life somatic symptoms such as sleep and appetite disturbance, loss of energy, tiredness, and fatigue indicate depression, whereas weight loss and loss of interest in sex are related to aging (Norris et al., 2004; Koenig et al., 1993; Norris and Woehr, 1998).

When comparing the youngest to the oldest age group, affective symptoms seem to be less prominent in the oldest age group. Gallo et al. (1997) described depression in late-life as “depression without sadness”. Studies by Fisch (1987), Conwell et al. (1998), and Waern et al. (2003) indicate that older adults may exhibit “masked depression” and present with more somatic and cognitive complaints than those with “traditional” depressive symptoms. However, a big cross-sectional study in the general population aged 65 years in Europe showed that death wishes, depressed mood, loss of interest, and pessimism are main depressive symptoms in late-life, whereas insomnia, fatigue and appetite changes played a minor role (Belvederi Murri et al., 2020). Longitudinal analysis from this cohort depicted that changes in sad or depressed mood, reduced interest, and suicidal ideation were most associated with changes in the rest of the symptoms (Savelieva et al., 2021). However, in this studies depressive symptom dimensions were not stratified by age.

In our sample, cognitive-affective symptoms seem to decrease with growing age. Feelings of past failure or punishment appeared to decrease with increasing age, raising the question whether fear of failure or punishment decreases and the relevance of current emotional conflicts increases as people age. Åström et al. (2019) also found a positive association between depressive symptoms and negative views of the past in older age but noted that with age, people become more concerned about the present than the future. In our study, suicidal thoughts were less common in older participants, which is consistent with Conwell et al. (2002), who found that older adults are less likely to communicate suicidal intent. Over half of adults aged 60 years and older are at risk of social isolation (Fakoya et al., 2020). Feelings of loneliness are linked to depression and suicidal behavior, especially in late life (Calati et al., 2019; Fakoya et al., 2020). A shift in symptom perception may explain why severe depressive symptoms decrease with increasing age and minimal ones increase.

Individuals in our study exhibited varying levels of depressive symptoms without meeting the criteria for clinical depression according to DSM-5 (American Psychiatric Association, 2013) or ICD-10 (World Health Organization, 1992). However, the presence of minimal to moderate depressive symptoms may indicate a possible prodromal state of depression and can also affect well-being. This concept is supported by research indicating that mild depressive symptoms can be clinically significant and affect quality of life and functioning (Judd et al., 1996; Cuijpers and Smit, 2004).

4.8. Limitations

This study has several limitations, including the retrospective cross-sectional design. Further research needs to explore causality and changes over time longitudinally and to develop prediction models for transition to MDD. Another limitation is the self-rating of depressive symptoms; however, an evaluation of the BDI-II in inpatients aged 55 years and older with MDD or adjustment disorder with depressive mood showed high internal consistency (coefficient alpha, 0.89; Steer et al., 2000). In addition, adequate-to-high internal consistency was measured in older Americans (Gallagher et al., 1982) and community dwellers (Segal et al., 2008; Balsamo et al., 2018). The mean BDI score correlates significantly with the population prevalence of depression determined by a physician (Veerman et al., 2009). Prevalence rates in our sample were similar to other large population-based studies. Because of the high rates of minimal depressive symptoms, further research into early recognition and effective interventions for older adults at risk for worsening of depressive symptoms is urgently needed.

5. Conclusion

Our study found that with increasing age, the prevalence of severe depressive symptoms decreases and that of minimal depressive symptoms increases. Symptoms such as feelings of failure, self-dislike, punishment, and changes in appetite appear to be less prominent in older adults. These findings suggest that symptomatology shifts as people age and emphasize the importance of recognizing and addressing depressive symptoms, which may be a prodrome for MDD.

Early detection of older individuals at high risk for MDD is crucial. Our data indicate that participants with low educational levels, a history of psychiatric or neurological treatment, lower cognitive functioning, obesity, joint disease, polyneuropathy, and use of PPIs and antihypertensives have higher severity of depressive symptoms. In older adults, chronic diseases significantly contribute to the risk of depressive symptoms.

To mitigate the above risks, it is essential to develop early detection and screening instruments tailored to older adults. Early detection instruments should address cognitive impairment, reduced quality of life, and lower functionality due to multimorbidity, and screening tools should address social isolation, loss of autonomy, and chronic pain. By focusing on these medical and psychosocial aspects, we may be able to better identify and support older adults at risk of developing more severe depressive conditions.

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CRediT authorship contribution statement

Julia Christl: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Pascal Grumbach:** Visualization, Methodology, Formal analysis, Data curation. **Christiane Jockwitz:** Writing – review & editing, Validation, Methodology, Data curation, Conceptualization. **Natalia Wege:** Writing – review & editing, Validation. **Svenja Caspers:** Writing – review & editing, Supervision, Project administration, Conceptualization. **Eva Meisenzahl:** Writing – review & editing, Supervision, Conceptualization.

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Declaration of competing interest

The authors have nothing to declare.

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